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Office of Personnel Management

# Electronics Technician Series

**GS-0856**

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## **NOTE**

This standard has been converted from the original paper format to electronic format without substantive change in series coverage or grading criteria. The standard was reviewed to correct errors that may have been introduced during the conversion process. In some standards minor corrections were made such as updating references to other documents that may have become obsolete, or correcting minor typographical errors in the original standard. Any errors that remain due to conversion to electronic format should be minor and are not intended to change the meaning of the original standard.

If you find page references near the right hand margin of this standard they indicate the pagination of the official, printed version of this standard. For example, a notation "PAGE 2, 4/88, TS-87" would mean that (1) page two of the printed version begins here, (2) the date of issuance was 4/88, and (3) the Transmittal Sheet number was TS-87.

# Electronics Technician Series

GS-0856

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## **SERIES DEFINITION**

This series includes positions that require (a) the knowledge of the techniques and theories characteristic of electronics such as a knowledge of basic electricity and electronic theory, algebra, and elementary physics, (b) the ability to apply that knowledge to duties involved in engineering functions such as design, development, evaluation, testing, installation and maintenance of electronic equipment, and (c) a knowledge of the capabilities, limitations, operations, design characteristics, and functional use of a variety of types and models of electronic equipment and systems. Such knowledge is related to but less than a full professional knowledge of electronics engineering.

This standard supersedes the standard for the Electronic Technician Series, GS-856, Parts I and II, issued in December 1958. (In October 1962 the grade-level criteria for Electronic Maintenance Technicians alone were rescinded and the rest of the standard has remained in effect until now.) This standard does not supersede the single-agency standard issued in October 1962 for maintenance positions in the Federal Aviation Agency.

## **INCLUSIONS**

Characteristic of positions in this series is the requirement for theoretical knowledge about the fields of electricity, electronics, physics, and, in some cases, engineering mechanics, that is less than full professional engineering knowledge, but which nevertheless enables the technician to understand how and why a specific device or system embodying electronic principles operates. Electronics technician positions require the ability to follow schematic diagrams and block diagrams and in many cases to construct devices in accordance with more or less detailed instructions (depending upon the requirements of the assignment). At the higher levels electronics technicians modify or elaborate upon basic electronic designs in order to make them work in accordance with the engineering objectives which have been set.

While many electronics technicians combine their knowledge of electronic theory and their ability to use their hands and their tools in order to carry out their assignments, the knowledge of electronic theory is the paramount requirement of the assignment and the manual dexterity and skill, while sometimes needed, is secondary.

## **COVERAGE OF THE SERIES**

The Electronics Technician Series, GS-856, is the technician counterpart of the Electronics Engineering Series, GS-855, and thus, in effect, the Electronics specialization of the Engineering Technician Series, GS-802. The Electronics Technician Series has been

identified as a separate series because of the large number of positions involved, the distinctive knowledge and skill requirements, the well-established academic curricula in the field at technical institutes, the similarity of the required knowledge of electronics to that typical of professional engineering positions (professional engineers are more intensively and broadly trained in related sciences and technology), the special problems resulting from the marked overlap of positions in this occupation under the Classification Act and similar trades positions, and the traditional recognition of this field as a distinctive technician occupation.

### **DISTINGUISHING BETWEEN PREVAILING WAGE AND CLASSIFICATION ACT POSITIONS**

Section 202 (7) exempts from the Classification Act "employees in recognized trades or crafts or other skilled mechanical crafts . . . having trade, craft . . . experience and knowledge as the paramount requirement." Such positions are compensated by reference to prevailing wages in private industry.

Guidelines for the Determination of Trades, Crafts or Manual Labor Positions, Section IV of the Commission's Introduction to Position Classification Standards (issued August 1963) contain general criteria for determining the exemption from or inclusion under the Classification Act of mixed and borderline positions. The following discussion covers the application of the legislation and guidelines to the determination of pay system coverage of mixed and borderline positions in the electronics field.

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In the field of electronics there is a well-established, recognized trade or job family referred to here as electronics mechanics. Many of the Wage Board positions in electronics, particularly those concerned with troubleshooting analyses of complex systems, require for full performance a knowledge of electronics that approaches in kind the knowledge of electronics applied by professional electronics engineers engaged in functions such as test, maintenance, and installation. In such cases, the electronics mechanics apply knowledge and ability which seem to be technical engineering knowledge and ability. In this respect the exempt electronics mechanics positions appear to have characteristics of positions under the Classification Act.

On the other hand, many electronics technician positions which are unequivocally under the Classification Act (e.g., whose primary purpose is to perform subprofessional engineering work in designing, developing, and evaluating new units of electronic equipment) have, as a secondary requirement, well-developed craft-type skills in the use of hand and power tools and in wiring, construction, and assembly of components. In some positions, these trade skills are fully comparable to those of the shop mechanic. Moreover, one of the sources of recruitment to fill such technician positions is from among Wage Board mechanics. Yet the

*paramount requirement* is to perform subprofessional work on electronic equipment, such as design, experimental development, and evaluation.

Electronics mechanic apprentice programs generally include formal coursework in mathematics and electronics which is comparable to that offered in college-level technical institutes whose primary purpose is to train quasi-professional engineering technicians. In fact, some

apprentice programs in electronics include such college work as an integral part of the program. Such apprentice programs provide appropriate preparation for electronics technicians as well as electronics mechanics.

In terms of the primary classification factors -- the duties performed, the responsibilities discharged, and the qualifications required -- many of the positions contain mixed functions, some of which are trade or craft in nature and others of which are properly under the Classification Act. There is no sharp line of distinction among such positions but rather a spectrum which ranges from positions which are clearly Wage Board to positions which are clearly under the Classification Act. A large body of positions falls between these extremes with varying combinations of characteristics of both.

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In such a situation any decision as to the paramount requirement of the work for pay category purposes must be based on considerations such as career patterns; job environment; required application of knowledge of and participation in operating programs, time spent on trades and crafts functions as against Classification Act types of work; and management requirements and intent for consistency, equity, and economy.

In ascertaining whether a position should be placed under the Classification Act or in a Wage Board occupation the following guidance may be helpful:

1. Certain functions are characteristically Wage Board in nature, e. g., overhaul and repair of electronic equipment. Positions in which such functions are paramount are Wage Board regardless of the complexity of circuitry and the breadth of knowledge required.
2. Certain functions are characteristically Classification Act in nature, e.g., subprofessional electronics engineering work performed in (a) the developmental design and evaluation of equipment to meet operational requirements; (b) establishing methods and procedures for use by others in preventive maintenance of operating equipment; (c) originating and developing modifications to electronic equipment to change its operating characteristics, to improve reliability, or to enable it to operate compatibly in conjunction with other equipment; and (d) monitoring the radio spectrum for regulatory purposes. Positions in which such functions are paramount are under the Classification Act even though mechanical or trade skills and abilities may be required or associated with the work.

3. For positions involving functions such as maintenance, operation, installation, construction, testing, and calibration of electronic equipment, factors such as the job environment, career patterns and management intent and requirements should be carefully considered. For example, a position involving testing and calibration of electronic instruments used in an overhaul and repair shop where the career development and promotion ladders are toward the shop foreman and superintendent positions would typically be a Wage Board position. A position with substantially identical duties and knowledge requirements in an engineering or research organization where career development and promotion ladders clearly point toward higher grade electronics development technician positions would typically be under the Classification Act.

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4. A function such as installation of equipment performed in accordance with specifications, blueprints, and/or specific instructions is normally regarded as a Wage Board function. However, responsibility for planning and directing the installation of complex electronic systems, particularly where there are problems of site selection, systems integration, and modification of the equipment to adapt to novel site characteristics, frequently requires and is performed by a professional engineer. In such cases, nonprofessional employees who perform comparable managerial and technical work with or in lieu of the engineer are typically in Classification Act positions.

5. Although the performance of preventive and corrective equipment maintenance per se is normally a Wage Board function, in some positions such maintenance is an integral part of the testing, analysis, alignment and performance evaluation of complex electronic systems. These four functions may be regarded as subprofessional engineering functions in greater or less degree depending on circumstances. For example, the maintenance of experimental or pilot models of systems may be an integral part of an engineering evaluation function. Here, too, in borderline cases whether the environment, career ladder, etc., are shop-oriented or engineer-oriented may actually control the determination as to whether the position is Wage Board or Classification Act in nature.

6. In some situations regulatory, operating, or other associated functions may bear on the classification of the position. For example, detecting malfunctions of equipment may be incidental to making unreviewed technical evaluations and to deciding to remove from use or to keep in operation systems which play a vital role in air navigation and air traffic control operations.

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In conclusion, the determination of whether the primary duties performed have, as a paramount requirement, the use of trade or craft knowledge and experience is crucial in determining the pay system for individual positions. Trade or craft knowledge is a requirement for some positions in the Electronics Technician Series, but not the paramount or

most important requirement as it is in exempt positions. Many of the duties and responsibilities of exempt and nonexempt positions are superficially similar. The distinctions, therefore, must be based on a careful analysis of the duties and responsibilities and the qualifications required for performance of the work.

## EXCLUSIONS

Excluded from this series are Classification Act positions whose incumbents are not required to understand and apply a practical knowledge of electronic theories and principles, even though they are dealing with electronic equipment.

As an illustrative example, an employee may perform work involved in planning the installation of electronic gear in an aircraft, a submarine, or a building. He must consider such factors as size and weight of the gear in relationship to available space, weight-bearing loads, nature and availability of power sources, function of the components in terms of physical proximity to each other, ease of operation and of reading instruments, and convenience for maintenance. In such a situation, the employee does not apply a knowledge of electronic theory, transistor theory, or circuitry. Consequently, his work does not fall into the Electronics Technician Series, GS-856. (See the Engineering Technician Series, GS-802, and Equipment Specialist Series, GS-1670.)

As another example, an employee is responsible for representing his agency's interests in the fulfillment of a production contract for an electronic device. If he is concerned primarily with production schedules, time deadlines, shipping and procurement scheduling, etc., the work does not require knowledges and abilities described above as characteristic of electronics technician work and the position is not classified to the Electronics Technician Series, GS-856, even though the employee is concerned with electronic gear and equipment.

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Classification Act positions below grade GS-4 involving work with electronic equipment are classified in the Engineering Technician Series, GS-802.

The following passage from the Introductory Material for the Engineering and Architecture Group, GS-800, is quoted here in order to present the flavor of technician kinds of positions. The material was originally developed as an aid in distinguishing engineering technicians from professional engineer positions, but it succeeds so well in characterizing engineering technicians of all types that it will also be of some help in determining whether a given position falls into the electronics technician category.

Although most engineering technician positions involve the performance of tasks of relatively restricted scope, many such positions resemble professional engineering positions of comparable level because of one or more of the following characteristics:



1. Expert, specialized knowledge of a narrow range of activity such as tool design, installation of electronic equipment, construction estimating, specification writing, etc., acquired through intensive on-the-job training and experience in the application of methods and techniques.
2. The application of principles of physical science and mathematics including algebra and trigonometry, to the solution of engineering problems.
3. The application of highly developed instrumental skills.
4. Independent performance of technical work of a high degree of difficulty requiring the exercise of originality, initiative, and practical judgment in the application and adaptation of standardized engineering techniques and methods.

For example, in some engineering organizations concerned primarily with practical engineering problems in conventional areas of endeavor, e.g., design and construction of buildings and utilities on military posts, almost all of the detailed engineering work performed requires limited reference to basic scientific considerations. Most of the engineering problems have been repeatedly encountered by engineers. The methods of attack on the best solution have been established and formulas and guides have been developed and published in numerous textbooks and handbooks. Although calculus and scientific principles may have been applied in derivation of the formulas, the application of the formulas to the practical problems encountered is typical of technician positions.

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The following sections on *Characteristics of Electronics Technician Positions* and on *Specializations* amplify the above general criteria and should be considered carefully in making specific series determinations.

## **CHARACTERISTICS OF ELECTRONICS TECHNICIAN POSITIONS**

Electronics is that branch of science and technology that deals with the conduction of electricity in a vacuum, in a gas, and in semi-conductors. The concepts, principles, data, techniques, criteria, and practices involved in electronics typically relate to such matters as (a) amplification of minute electrical currents and voltages, (b) production and utilization of oscillations at acoustic, radio, and microwave frequencies, (c) fidelity of transmission of waveforms, (d) elimination of interference and distortion, (e) selective reception of frequencies, (f) modulation and demodulation of waveforms, (g) pulse techniques, (h) precise timing, synchronization, switching, control, and trigger circuits, (i) sensitivity of circuits to signals, (j) radiation and propagation of electro-magnetic waves, (k) electron emission, and (l) the conversion of electrical, magnetic, mechanical, optical, physiological and other stimuli into forms suitable for measurement or process control.

Electronics technicians apply a knowledge and understanding of the electronic subject matter applied above in performing work connected with the development and evaluation of design characteristics of all kinds of equipment, devices, and systems that embody electronic principles. They test and operate such equipment in order to establish its operating characteristic parameters, and permissible tolerances.

Electronic equipment may be used in the fields of radio communication, television, telemetry, radar, sonar, medical equipment, computers, and many others.

All of these different kinds of equipment are designed, developed, constructed and operated to do a variety of essentially different kinds of things that are often completely unrelated to each other in terms of their objectives, and which cover all the areas of modern technology. However, the electronic components of all of these different systems and devices are essentially the same -- vacuum tubes, resistors, capacitors, diodes, transistors, etc. The circuits made up out of these various components may be standard in their configurations or they may have been especially designed to produce a specific waveform. What is common to all electronics technicians is the requirement for understanding the circuitry and associated waveforms, and, as they increase in knowledge and experience, the requirement of knowing the kinds of circuits to be used to produce specific results.

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When a technician is assigned to do development, testing, or other work on a piece of electronic equipment that is new to him, he applies his knowledge of electronic theory, circuit design, and the operating characteristics of equipment with which he is familiar. He refers to the diagrams, troubleshooting procedures, operating guides and technical literature, seeks information from other technicians and from engineers, and may take a factory training course in order to become familiar with the new piece of gear. It is this ability to apply general knowledge of electronics and to transfer experience and knowledge from one kind of equipment to another that characterizes electronics technicians.

One of the characteristics of electronic equipment is, that although a given device works perfectly in the laboratory or under test conditions, external factors, such as other devices with which it may be interconnected, geographical and climatic conditions, interference from other electronic equipment, may have a definite although unanticipated effect on its adequate functioning. Therefore, electronics technicians develop, to a greater or lesser degree, knowledge and experience concerning how external forces affect the functioning of electronic devices and what methods may have been used successfully in similar circumstances.

## **SPECIALIZATIONS**

Electronics technicians work in areas that are specialized in nature either in terms of the kinds of things they do, or in terms of the kinds of equipment they work on.

In terms of specialization by function, electronics technicians perform development work, testing and evaluation, establishment of maintenance standards, etc. Performance of any one of these functions requires the application of essentially the same kinds of knowledge and experience as performance of any of the others. Consequently, although specialization by function may exist, it is typically based primarily upon administrative or other reasons, rather than upon the specialized knowledge or experience requirements of the position.

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Electronics technicians may also specialize by nature of equipment; they may work with radar, sonar, radio communication equipment, telemetry instruments, fire control systems, computers, or a wide variety of other equipment that utilizes electronics. In order to carry out any functional assignment related to a given type of equipment, an electronics technician must understand, in addition to the fundamentals of electronic theory, exactly what circuitry is involved and how that piece of equipment works. Commonly for the technician this knowledge of a particular piece of equipment is derived from study of the equipment and its documentation such as its schematics, manuals, operating instructions, etc. However, a technician who has attained understanding and knowledge of a specific piece of equipment such as a radar will still have to study a new kind of radar and its documentation in order to attain familiarity with it. He will, of course, have an edge on the technician whose knowledge of electronic equipment has largely been with computers, for example; nevertheless, the basic knowledge of electronic circuitry and components does enable the computer man to find his way around radars.

Specialization in terms of equipment, when it occurs, is generally not in terms of "radio communications," "radar," or "computers" but in much finer subdivisions of these broader categories. Lacking applicants with experience in precisely the same kinds of equipment, such specialized positions are filled through evaluation of the applicant's ability to apply a broad knowledge of electronics to the specific equipment in question rather than specialized knowledge of that "class" of equipment.

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Therefore, we have not established formal classification specializations within the electronics technician occupation based upon subject-matter experience or functional assignment.

## TITLES

The authorized titles for positions in this series are *Electronics Technician* and *Supervisory Electronics Technician*.

Note: The authorized titles have been changed from "Electronic" to "Electronics" in response to the views of the professional community.

## CLASSIFICATION CRITERIA

The following criteria are used to evaluate the grade-level differences in this occupation: (1) The kind and degree of knowledge about electronics required; (2) the operational setting in which the work is performed; and (3) the kind and degree of technical responsibility exercised.

### *1. Knowledge of electronics*

The knowledge of electronics, both theoretical and practical, possessed and applied by an electronics technician is one of the major factors influencing the level of work performed. However, it is extremely difficult to quantify knowledge of a particular discipline or subject matter and to express in words a degree of knowledge that will serve as a grade-level criterion. Therefore, the degree of electronics knowledge required in electronics technician positions must be measured by means of other factors that will serve as a reliable index of the knowledge required.

The two criteria that most satisfactorily serve as indicators of the degree of electronics knowledge required are: (a) the kind and level of work performed; and (b) the nature and complexity of the equipment involved.

#### *a. Kind and level of work performed*

This factor covers the various functional operations performed by electronics technicians such as development, evaluation, modification, installation, and maintenance of equipment.

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Within each of these functions some of the work performed is relatively simple; other work within the same function requires more knowledge, skill, and ability.

For example, development work that consists of the construction and modification of electronic equipment may vary from following a schematic diagram which shows in detail each component, its specifications and requirements, location in the circuit, and the specific layout of the finished product, to the kind of assignment which involves developing the circuitry required in a device based upon a block diagram which specifies the purpose of each circuit, but leaves to the technician the selection of the optimum values of each of the components, their configuration, and their physical location in the final layout.

#### *b. Nature and complexity of the equipment*

The term "electronic equipment" can cover anything from a vacuum tube to a weapons system and all of the variations in between. Essentially, electronic equipment can be thought of as

being made up of electronic circuitry that is designed to transmit, receive, modify, amplify, or display an electronic signal, either visually or by transforming it into sound waves.

Combinations of such circuits together make up units that perform discrete functions. These units contain all of the circuits necessary to perform that function. Units are combined to make up subsystems. As commonly used, subsystems refer to combinations of units that perform discrete functions to the signal such as transmitting it, or amplifying it, or displaying it. When these subsystems are combined into a system, what happens to the signal in one part of the system is affected by the proper functioning of all other subsystems making up the system.

Each component used in an electronic circuit is manufactured to meet specified tolerances which represent an allowable degree of deviation. Each unified circuit and each unit must likewise conform to specified tolerances. Components, units, or subsystems -- as they take their place in the configuration of an electronics system -- increase the chance of deviation of the entire system from specified tolerances, even though all of the components involved are within specifications.

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The following criteria are used as indicators of the complexity of equipment.

(1) The definition of an electronic system as presented above is necessarily general and therefore imprecise. However, one important aspect of complexity of equipment (as it affects an electronics technician's assignment) is whether the equipment he works on represents an entire system, a subsystem, or a unit. Interpretation of this criterion may be difficult; in some cases the system involved may be widely dispersed with the technician working only on that portion of the system in his geographical location; in other cases, there may be legitimate argument for determining that the equipment in the assignment represents a system or a subsystem. Determinations such as these are best made in consultation with technically qualified persons. In some situations, even though the assignment does not involve working with a complete system, the electronics technician must have complete and thorough knowledge of the entire system, and must know absolutely the effect on the rest of the system of whatever he may do.

(2) Another major touchstone for determining the complexity of equipment -- as a measure of the knowledge of electronics exercised by the electronics technician -- is the *density of components in the equipment*. Density of components becomes an indication of complexity of equipment when limitations of size and weight complicate design layout and developmental construction of equipment. Density may also create a degree of inaccessibility that requires that the determination of problems be based upon highly knowledgeable use of test equipment, and a thorough understanding of the design characteristics and theoretical basis of operation of the equipment.

(3) *Sophistication of circuitry* is another indicator of equipment complexity. By this is meant the use of many different kinds of circuits to accomplish many different kinds of things within the same unit or subsystem. Such equipment represents a greater degree of complexity than equipment consisting of the multiple repetition of the same kind of circuit.

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(4) Another indicator of complexity in electronic equipment is the *amount and nature of documentation available*. Generally speaking, commercially produced and available equipment is adequately documented so that an electronics technician working with the equipment will have full information about that equipment. In some situations equipment has been nationally standardized by the headquarters agency and documentation has been worked out by the agency. Such documentation may take the form of agency instructions or manuals, maintenance schedules, operating and troubleshooting guides, etc. One-of-a-kind equipment, custom equipment, developmental equipment, or equipment which is continually being modified and adapted does not usually have adequate documentation. Consequently, the technician must work out for himself the details about circuitry, theory of operation, troubleshooting techniques, etc.

While the above four criteria serve as the major criteria on which to base a determination of the complexity of equipment, it is clear that they do not represent quantitative data. Indeed, these criteria can be applied only with informed judgments, based upon technical knowledge.

## *2. Operational setting*

Another element found in many positions in the Electronics Technician Series is the operational setting in which the employee works. All other things being equal, the technician who is required to work under conditions of extreme stress caused by the need to keep equipment in full operation, to meet impending deadlines that are out of his control must exercise greater knowledge and responsibility than the technician working on equipment that is not in line operation or against less rigid and demanding deadlines. When operational settings of extreme tension exist, consideration should be given in the classification of affected positions.

## *3. Kind and degree of technical responsibility*

This factor covers the nature of the technical supervision received by the electronics technician in the course of his work. This factor also measures the degree of final responsibility for his own work that the electronics technician has.

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## **NOTES TO USERS OF THIS STANDARD**

1. In the descriptions of grade levels in this standard, many individual duties appear almost indistinguishable from prevailing wage duties. These grade-level descriptions are to be used for evaluating positions properly under the Classification Act; they are not to be used as the basis for determining pay category. Such Classification Act positions may serve as training slots in the career ladder and are utilized by management, in conjunction with inhouse and other training courses, to train employees for higher level electronics technician positions.

2. Although the grade-level descriptions do not cover grades above GS-11, this does not mean that there are no exceptional circumstances where a position may justify classification above GS-11. The majority of those few nonsupervisory positions at grades GS-12 and above involve the performance of what are normally professional engineering duties.

Electronics technicians who perform such duties have acquired, over a long period of years, theoretical knowledge and experience that has qualified them to assume engineering assignments in the specific area of their long-time experience. Assignments such as these are classified in the GS-856 Series, but by comparison with the appropriate engineering series.

3. The grade-level descriptions in this standard do not cover specific assignments at grade GS-10. However, positions that are clearly above grade GS-9 but fall short of the requirements expressed in the GS-11 description should be classified to GS-10.

The Electronics Technician Series is a one-grade interval series.

4. The grade-level criteria in this standard apply to positions under the Classification Act that involve primarily the personal performance of development, installation, maintenance, and other electronic engineering function which require to a significant, but not paramount, degree, the application of trade or craft skill.

For positions that involve design, research, and other functions for which such trade skills are insignificant the grade-level criteria in the standards for the Engineering Technician Series, GS-802, the Equipment Specialist Series, GS-1670, or other appropriate series may be used as supplements to this standard.

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5. Positions classified on the basis of their supervisory duties are not described in this standard. When supervisory duties and responsibilities constitute a substantial, regular part of a technician's work and are of such significance as to require supervisory qualifications, the word "Supervisory" should be used as a prefix to the position title, and the position should be evaluated by the criteria in the Supervisory Grade-Evaluation Guide, Part I.

6. This standard is applicable to all positions in the Electronics Technician Series, GS-856, including those in the Federal Aviation Agency for which a single-agency standard has been

issued by the Civil Service Commission. That single-agency standard is to be considered as a specific application of the Government-wide standard to the operation, organization, and needs of the FAA.

### **ELECTRONICS TECHNICIAN GS-0856-04**

Electronics Technicians GS-4 work with and serve as assistants to electronics technicians of higher grade.

As trainees in the electronics technician career ladder, GS-4 electronics technicians are required to have a basic knowledge of electronic theory and practice, of mathematics, the fundamentals of physics as they relate to electronics and the ability to use and understand simple test equipment.

GS-4 electronics technicians assist higher grade technicians who are working on all kinds of electronic gear of any level of complexity; they themselves serve primarily as a pair of hands, replacing components, taking test readings, wiring circuits, in accordance with specific instructions.

GS-4 technicians become familiar with the operation, design characteristics of the electronic equipment they work on and become familiar with maintenance procedures and standards.

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GS-4 technicians work under close supervision and review, usually carrying out tasks at the specific direction of a higher grade technician. Their work is closely reviewed and checked for acceptability and conformity to requirements and standards.

### **ELECTRONICS TECHNICIAN GS-0856-05**

GS-5 electronics technicians receive assignments that require a good understanding of basic electronic theories and techniques and familiarity with standard electronic components and their uses. Such assignments are designed to afford training in the career ladder.

Electronics technicians at this level use basic test instruments and perform adjustments as necessary; they carry out prescribed procedures according to an established schedule. They receive training in the use of more specialized test instruments and learn simple troubleshooting procedures. At this level electronics technicians also learn to follow specific layout and schematic diagrams to construct and package simple devices and subunits of equipment such as power supplies, oscillators, amplifiers, etc.



GS-5 electronics technicians work under detailed supervision -- their work is carefully reviewed by technicians of higher grade or by electronics engineers. Assignments are usually fully covered by ample documentation and either written or oral instruction.

### **ELECTRONICS TECHNICIAN GS-0856-06**

Electronics technician positions are found at this level in two different situations.

1. They follow specific layout and schematic diagrams to construct or package simple devices or subunits of equipment essentially as described at the GS-5 level. However, the level of supervision is more general in nature. Electronics technicians at GS-6 may report to an administrative or program supervisor rather than to a technician or engineer so that their work receives no close technical review.

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2. Electronics Technicians GS-6 may also perform maintenance, operation, testing, development or other work similar to that described at the GS-7 level. In such situations, their work is reviewed by technicians of higher grade, or by electronics engineers. Their assignments are covered by ample documentation and detailed written or oral instructions.

### **ELECTRONICS TECHNICIAN GS-0856-07**

#### *Development functions*

Electronics Technicians GS-7 perform development work on critical units or subunits of a system or device. The difficulty of this equipment is usually such that it includes two or more circuits which pose problems because of the necessity for incorporating circuitry within limited space, interaction between components such as inductive and capacitive coupling, elimination of transient voltage, etc. Typical of the scope of this equipment are instrumentation devices such as firing units, safety switches and connectors; experimental types of antenna models used with direction finding receiving equipment, control units of a fuse assembly, electronic timers, etc.

Technicians at this level receive an explanation of the problem and of equipment requirements, obtain advice on unexpected results, work from rough sketches and in some instances block diagrams, and lean heavily on precedent type or parallel methods that can be extended or modified in completing the basic design concept of engineers or scientists. Work is reviewed for technical adequacy and accuracy, and adherence to instructions.

The following processes and tasks are characteristic of typical assignments:

#### *Design*

Prepares detailed circuit diagrams.

Analyzes the merits of various proposed or possible methods.

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Determines the general design approach.

Lays out circuits to provide adequate mechanical mounting support for components.

Makes calculations to determine value of basic components.

### *Construction and packaging*

Devises means of arranging, mounting and wiring components on a chassis to insure that possible sources of electrical interference are physically isolated or shielded, the length of leads are kept at a minimum to reduce the possibility of regenerative feedback, high voltage leads are adequately insulated, and circuit components are securely mounted on the chassis to avoid malfunctioning under extreme conditions of temperature, shock, and vibration.

Devises assembly techniques.

Constructs breadboard models of equipment of the difficulty and scope described above.

Meets specific shape, space, and weight requirements.

Constructs nonstandard components such as special high frequency coils, very low frequency chokes, cavity resonators, etc.

### *Testing and redesign*

Adapts test equipment for specific use.

Conducts a variety of laboratory and some field tests.

Uses and interprets standard as well as complex test equipment such as Q meter, signal generator, sawtooth generator, video amplifier, etc.

Tests and checks the effect of a few environmental factor such as temperature, humidity and pressure on equipment.

Traces circuitry, diagnoses malfunctions and adjusts controls to achieve peak performance.

Determines suitability of equipment in terms of objectives and recommends or redesigns circuits as necessary.

Furnishes instructions usually to contractors or users of the equipment, on standard test techniques.

### *Documentation*

Maintains a daily work log on progress and performance of equipment under development.

Prepares informal memorandums explaining test results.

Prepares schematics and wiring diagrams for completed equipment.

### *Other functions*

GS-7 technicians are expected to be able to carry out any maintenance task specified and documented by the manufacturer. They are also required to adjust the tolerances of the equipment to the maximum attainable by the manufacturer's design. Typically, the responsibility for maintenance and adjustments is limited to equipment that is a component of a larger system. For example, a GS-7 electronics technician is expected to maintain in operating condition (adjusting as necessary) a variety of tape recorders, of power supplies, or of radio transmitters, etc., in accordance with manufacturers' specifications with no technical supervision. He may, following precedents, marry such equipment into complete systems or develop front and back modifications to permit such marrying, but he is not expected to have the electronic knowledge and experience to plan and carry out a nonstandardized integration independently.

GS-7 technicians are expected to be able to perform maintenance, testing, and operating duties on one or a variety of different kinds of equipment with the characteristics outlined above. Variety in itself is not a grade controlling factor at this level since the different kinds of equipment involved involve the same basic knowledge of electronic circuitry.

GS-7 electronics technicians typically perform testing, maintenance, and operating work involving electronic equipment that has the following characteristics: The equipment is commercially available from many different manufacturers and is in widespread use. Generally speaking, it is a piece of equipment such as a tape recorder, radio receiver, transmitter, or display oscilloscope, which has many different uses and application when integrated into a larger system.

Such equipment is well documented in terms of schematic diagrams, maintenance schedules, troubleshooting procedures, etc. Regardless of manufacturer, the electronic theory on which it is based, the circuitry involved, and the design characteristics are fairly standardized so that the knowledge of electronics required to maintain, repair, test, or operate one specific type of equipment may be readily applied to other types of the same equipment.

GS-7 electronics technicians who work with equipment such as that described apply a knowledge of the electronic theory, design characteristics, maintenance requirements, troubleshooting techniques and specific peculiarities of the piece of equipment. Such knowledge may have been gained through specialized manufacturer courses, in-house, or other training courses.

At the GS-7 level, electronics technicians work under the supervision of electronics technicians or engineers of higher grade who have technical responsibility for the adequacy and correctness of the GS-7 technicians' work. These supervisors plan the work of their subordinates, fix the technical requirements of the work, and review completed assignments for conformity with instructions and requirements.

### **ELECTRONICS TECHNICIAN GS-0856-08**

GS-8 technicians typically perform maintenance, testing, operating and development work similar to that performed at the GS-7 level, but with a greater degree of independence and freedom from technical supervision. GS-8 technicians plan their own work and assure that it meets established technical requirements which are usually laid down in manufacturers' handbooks, and similar criteria. GS-8 technicians with this kind of assignment characteristically report to scientists or administrative officials who use the equipment in their work but are not knowledgeable in electronics.

Some Electronics Technicians GS-8 perform work similar to that described at the GS-9 grade level but under closer supervision. They receive guidance on the more complex aspects of assignments, e.g., that require problem exploration, selection of approaches, and development of new solutions.

### **ELECTRONICS TECHNICIAN GS-0856-09**

#### *Development functions*

Electronics Technicians GS-9 perform development work of limited scope on major units of a large system or comparable individual devices or assemblies. The difficulty of the development work is such that it requires some adapting of existing precedents or techniques,

exploring the possibility of and experimenting with conventional components and circuits, and exercising originality in adapting equipment to perform new or different functions to meet the objectives of the assignment. Units and devices are moderately complex, including, for example, oscillators, pulsing components, coincidence gates and time metering in a single package; special purpose circuitry such as data converters, switching matrices, parameter boards and oscillators relating to digital data processing; units of an instrumentation system in the microwave frequency band such as an amplifier of a wide band distributed type; units of a thermal radiation detector; etc.

Technicians at this level work under general supervision. They receive an outline of the objectives desired and description of operating characteristics and theory involved, and convert theoretical ideas of engineers and scientists into practical units or devices of electronic equipment. Assignments at this level are varied and have definite objectives. Detailed tasks do not follow a fixed pattern but require skill and ingenuity in designing some new circuitry by adapting and revising established procedures through experimental methods. Completed work is reviewed for compliance with instructions, adequacy, judgment, and satisfaction of requirements.

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The following processes and tasks are characteristic of typical assignments:

### *Design*

Obtains technical data and information on unusual design characteristics.

Analyzes technical data to determine applicability to design problem.

Determines and advises engineers on the relative practicality of developing new or adapting other equipment.

Prepares preliminary laboratory development plans including equipment layout and circuit diagrams.

Experiments with and adapts conventional circuits and components.

As assigned, instructs lower grade technicians in design methods and procedures.

### *Construction and packaging*

Establishes detailed construction and packaging requirements.

Selects circuits most applicable.

Determines component capabilities and proper utilization in the circuit.

Directs construction of mechanical parts by shop personnel.

Constructs components to meet specific frequency requirements, certain voltage ratings, etc.

Solves problems of size, weight and shape by recommending or utilizing techniques of printed and transistorized circuitry.

Integrates various circuits or units and packages prototype models into manageable operational form.

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### *Testing and redesign*

Participates in planning laboratory and field tests to be conducted.

Collects, analyzes and interprets test data.

Assures that test equipment is accurately calibrated.

Tests and checks the effect of a variety of environmental conditions including acceleration, shock, vibration, extremes in temperature and pressure, etc., on equipment.

Uses all types of test and measurement instruments such as frequency sweeping oscillator, oscilloscope for measuring extremely short duration electrical impulses, fast rise pulse generators, and equipment associated with microwave measurements.

Simulates conditions under which equipment must operate.

Adjusts voltage, gain, stability and other operating characteristics of circuits.

Solves or recommends solution of electro-mechanical and electronic problems that involve tolerance, component failure and marginal operating characteristics.

Analyzes and evaluates test results, determines necessity for redesign, and makes improvements to equipment being tested.

Redesigns newly conceived units and devices.

Conducts final test of laboratory or experimental models.

Instructs others in proper testing techniques and procedures.

Furnishes pertinent data to field or contract personnel on test problems.

### *Documentation*

Maintains complete records of laboratory and field tests.

Prepares normal performance test reports including analysis of results.

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Prepares data in graph, chart and table form.

Writes instructional material on adjusting and calibrating equipment.

Furnishes data for detailed specifications including dimensions and tolerances on newly developed equipment.

Prepares check-out procedure for operating and maintenance personnel.

May prepare or assist in the preparation of formal reports on new processes or equipment.

### *Other functions*

GS-9 technicians who perform installation, maintenance, operation, and testing duties work with electronic equipment with the following characteristics:

The equipment is typically specially designed, constructed, or modified to fill a specific function peculiar to the organization using it. Such may be found at many different agency installations. In many cases modifications are initiated by the agency headquarters to meet agency program or operating requirements, or by the local installation in order to meet local requirements caused by geographical, program, or other requirements. The factory documentation, therefore, may have been modified to reflect changes made subsequent to manufacture. Electronics technicians at this level must recognize and know how to deal with such modifications and incomplete documentation and to reflect changes in the documentation.

GS-9 electronics technicians typically are concerned with complex electronic systems which are made up of combinations of components assembled into a configuration designed to accomplish specific objectives (for example, a radio communications system, a weather radar

system, a telemetry system). This is in contrast to GS-7 technicians who work primarily on the disparate components of these systems.

In some instances, however, GS-9 electronics technicians work primarily with subsystems that are notably complex by reason of miniature size, density of circuitry, lack of available documentation, etc. In some cases inaccessibility of equipment either in remote spots, in high towers, or in cramped quarters increases the difficulty of the electronics technician's work since he must accomplish his objective without the aid of bulky test equipment, without time for trial-and-error approaches, and in such a way as to assure trouble-free operation with infrequent attendance by the technician.

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GS-9 electronics technicians typically carry out all phases of maintenance, troubleshooting, installation, operation, and testing of electronic systems. They are expected to be thoroughly familiar with the theory, design characteristics, operation, and functions of the equipment they work on as well as the individual requirements and modifications deriving from site and program characteristics. They work with a high degree of independence and are technically responsible for the quality and accuracy of their work which is typically reviewed on a spot-inspection basis only.

Some GS-9 technicians are responsible for the performance of maintenance work on complete electronic systems of considerable complexity, or on subsystems of the most complex electronic systems used in air navigation control. They determine scheduling of maintenance on the assigned systems within the prescribed annual schedule to meet emergency situations or adjustments in the schedule required by the needs of air traffic control. When such situations arise they are also expected to develop and initiate changes in prescribed procedures to expedite corrective action and provide continuous operation when required. They determine that the system is to be removed from service, allowed to remain in service, or restored to service. In doing so they must weigh the impact of such action on the system and airways operation and make the decision that their action is correct and will not result in loss of life and property damage to aircraft.

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## **ELECTRONICS TECHNICIAN GS-0856-11**

### *Development functions*

#### Electronics Technicians GS-11:

1. Perform development work and conduct research by the application of previously established experimental and empirical methods and techniques, interpret results and select or recommend approach appropriate to the solution of the design problem. Incumbents serve as



specialists in a narrow aspect of electronic engineering such as in environmental suitability, the development of new components such as solid state devices for instrumentation equipment, or in the application of new circuits in units or devices with very critical tolerances or performance characteristics. Typical of the scope of design problems and equipment are trigger circuits with controllable delay, new purpose multistage electronic circuits, new units intended for operation at frequencies not previously explored, etc.; or

2. Plan, organize and execute a limited project involved in the development of a system with performance characteristics which require the solution of both design and operational problems. Project responsibility involves consideration of time, materials, cost, safety and performance requirements. Typical of the scope of a system are the external and internal development of general purpose transmitters for fixed plant installation with a wide range of power output, and accessory equipment such as power supplies, receiver-converters, exciters, antennas, terminal and special test equipment; rocket instrumentation systems used for direct probing of the high atmosphere including remote control unit for operating and monitoring the systems and associated telemetering devices; etc.

Technicians confer with engineers or scientists and engage in a general discussion of the overall objectives desired. They are responsible for visualizing, suggesting, and working out a solution to design or operational problems, and selecting a practical approach which will be most fruitful. Development work at this level requires a high degree of adaptability and the injection of original ideas in completing the project leader's concept of new equipment. Supervisory assistance is available to solve unusual problems and completed work is reviewed for compliance with overall project objectives.

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The following processes and tasks are characteristic of typical assignments:

### *Design*

Plans basic approach to resolve design problems.

Searches technical reports of research investigations for information to evaluate the feasibility of incorporating new types of components, units or devices in the equipment.

Determines that basic objectives are not contrary to general electronic principles.

Conceives and recommends new design techniques.

Assures that the design is not incompatible with other parts of the system.

Determines basic type of physical instruments that will be necessary in equipment.

Resolves design problems with contract personnel.

Coordinates and integrates design tasks.

### *Construction and packaging*

Conceives special methods of assembling laboratory and prototype models.

Develops new methods of packaging prototype models.

Uses and advises contractors or other technicians on new material.

### *Testing and redesign*

Designs test setups and experiments to measure and develop criteria, i.e., to prove or disprove the feasibility of preliminary design.

Uses previously untried and untested measurement techniques.

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Obtains optimum operational efficiency by improving performance until final model possesses required features.

Performs final evaluation of new equipment.

Evaluates test results in terms of feasibility, operational sufficiency, and attainment of objectives.

Participates in preflight interference check on instrumentation equipment.

Advises equipment users on redesign to solve unique operational deficiencies.

### *Documentation*

Writes technical reports on projects covering progress, evaluation, analysis and conclusion on the application of new or modified devices.

May prepare technical papers on new processes in development work for publication in scientific journals.

Contributes to the preparation of formal reports on special technical investigations or studies.

### *Other functions*

GS-11 technicians who perform installation, maintenance, operation, and testing duties perform functions similar to those described at GS-9. However, they are responsible for the work on one or more complete electronic systems, that are classed as among the most complex by virtue of such characteristics as: (1) the great extent to which numerous subsystems are interrelated, (2) the geographical dispersion of many subsystems of the total system, (3) the degree to which malfunctioning or incorrect values anywhere in the system will adversely affect its total operation, (4) incomplete standardization of the system, and (5) the failure of the system in any aspect will be directly responsible for the failure of the mission of which it is a part. In these situations, scientific research involving extensive investments of skilled scientists, time, and money; effective law enforcement; or the protection of life and property hinge upon the accuracy and reliability of the electronic components of a project.

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Employees assigned to positions at the GS-11 level typically also establish the sequence and timing of complex projects; work out arrangements with suppliers, contractors, and other governmental or private organizations who either participate in or whose operations are drastically affected by the progress of the project; and solve problems arising from the conflicting requirements of these different organizations. Typically, employees at GS-11 direct and supervise a small work force. Positions whose supervisory functions are grade controlling are evaluated in accordance with the Supervisory Grade-Evaluation Guide, Part I.

GS-11 electronics technicians report to engineers, technicians of higher grade, or program officials and are responsible to them for technical results, and for conformity to agency requirements and regulations.